CENTER FOR RESEARCH, INC.
UNIVERSITY OF KANSAS

ERTS DETAILED IMAGE INTERPRETATION REPORT

CRINC DIIR No. 2262-1
Date Prepared 9 Jan 73

Subject:

Influence of atmosphere pathlengths for different bands.

Subject Geographic Coordinates 37-24N/98-54W

NASA Test Site No. N/A

NASA Image Descriptors:

Report Summary: Comparison of ERTS-1 imagery in three bands (MSS-4,5, 7) acquired over southwestern Kansas on 1 DEC 72 reveals that low solar altitude has a pronouncedly different effect on apparent scene illumination in different bands.

Imagery References

CRINC Image No.	NASA Image ID Block	Subject Image Coordinates X	Y	Cloud Cover	Image Quality
MP00454	E-1131-16462-4	N/A		0	Good
MP00455	E-1131-16462-5	N/A		0	Good
MP00456	E-1131-16462-7	N/A		0	Excellent

Map References: USGS NJ14-8 Scale 1:250,000

Digital Data Used Yes ___ No X

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Comparison of ERTS-1 imagery in three bands (MSS-4,5,7) acquired over southwestern Kansas on 1 December 72 reveals that low solar altitude has a pronouncedly different effect on apparent scene illumination in the different bands. The images were acquired with sun elevation of 26° and azimuth of 154°. These angles cause the imaged scene to be illuminated nearly directly in front of the satellite with long shadows cast toward the direction of satellite approach. Consequently, total scene illumination is low and only fore scatter is imaged by the sensor.

The primary consequence of low solar altitude is loss of illumination per unit area. With solar altitude equal to 26°, only 43.8 percent of possible illumination (vertical sun) per unit area of flat surface occurs. By comparison, this same area was imaged on 28 July 72, when solar altutude was 58°. That altitude results in 84.8 percent of possible illumination per unit area.

The effects of low illumination per unit area are most prominent on bands 4 and 5 while band 7 exhibits good scene contrast. In the visible bands all non-snow covered objects are medium gray to black on the film positive. Contrast of the same targets in band 7 ranges from nearly white to black.

This lack of scene contrast cannot be attributed to sensor or processing deficiencies because a small portion of the frame is snow covered and the snow images white in all bands.

The apparent greater loss of reflectance in bands 4 and 5 is related to the pathlength of incoming energy through the atmosphere. Pathlengths were calculated from the Mesopause ($\sim$50 miles, 80 km above Earth surface) for solar altitudes of 26° and 58°. At 58°, the pathlength is $\sim$59 miles whereas at 26° the pathlength is $\sim$114 miles. Because bands 4 and 5 are in segments of the spectrum with shorter wavelengths, they are subjected to more Rayleigh scattering than the longer wavelengths of band 7. This obviously contributes to less illumination availability in band 4 and 5 wavelengths.

Direct cost of preparation of this report was 5 hours interpreter time.